1:Beaglehole and Beaglehole E-5 (1934-5)1938 Pukapukans

most village, Ngake, formerly occupied Utupoa, the southeastern arm of Wale. After the wave of 1914, houses were rebuilt on the lagoon frontage contiguous to the houses of Loto, and other houses were built on a section of land extending from the lagoon to the outer beach. This section of Ngake faces the outer beach extension of Loto. The two extensions occupy opposite sides of the village road. The reserve of Ngake is Motu Ko. Land at Utupoa is also used as a reserve, but sections here are owned by individual lineages and not by the village as a whole.

All three islets are intersected by paths and trails. The main road (*ngutuala*) of Wale extends from the landing beach, through Yato, across the causeway, and through Loto. One branch makes a right-angled turn and passes to the outer beach, to the courthouse, residency, and the outer sections of Loto and Ngake. The other branch runs through the lagoon section of Ngake. Formerly it led to the Utupoa site of Ngake. This wide main road is well kept and bordered by coral stones. From it branch off trails and smaller paths leading to the outer beaches and the reserves. These paths, as well as the many paths on Motu Ko and Motu Kotawa, are named after persons, either contemporaries or those now dead, who originally cut the clearings through the bush. Contemporaries cheerfully accept the responsibility of keeping their paths clear, and descendants of those after whom the paths are named accept the same responsibility.

Each village and reserve has a number of alternate names that are frequently referred to in chants and conversation:

Village or Reserve	Old Names	Remarks
Ngake	Pana-ole	'Erect-penis'
	Te Yawea	—
	Te Langaikuia	Refers to kilts (titi) of pandanus dyed red, worn by Ngake villagers at festivals.
	Kilimanea	'Bird Skin', name taken when birds were plentiful on Motu Ko.
Loto	Awaiua	Name of legendary land.
	Kotipolo	'Cutting of palo leaves'.
	Tuetuetu	—
Yato	Takaumui	'Circle'?
	Ulukowa	'Penis-of-ostrich'?
Motu Kotawa	Te Nuku-ya-o-Matalíki	Sacred-isle-of-Matalíki'
Motu Ko	Te Nuku-loa-o-Matalíki	Long-isle-of-Matalíki'

The western half of the lagoon, including Motu Kotawa and the western half of Wale, is also called Te Lau-la-lalo no Te Ulu-o-te-watu (Lower-part-of Head-of-the-rock). The eastern half, including Motu Ko and the eastern half of Wale, is called Te Lau-la-lunga no Te Ulu-o-te-watu (Upper-part-of Head-of-the-rock).

PLACE NAMES

A list of 140 representative place names, including all the names of paths and trails, talo gardens, land section, household lots and other division names collected in Pukapuka, is on file in the library of Bernice P. Bishop Museum.

[1] Matalíki (mata aliki, chiefly eyes) refers to the lineage and supervising these reserves and is not to be confused with Matalíki (mata liki, tiny stars), the name of the Pleiades.

1:Beaglehole and Beaglehole E-5 (1934-5)1938 Pukapukans

301 proximal end; shank (3) 3¼ inches long, ¼ inch thick at proximal end, ¼ inch thick at distal end; each shank ¾ inch wide at proximal end, ⅛ inch wide at distal end; outer shell (2) also of gold-lipped shell, polished smooth; greatest length 4¼ inches, greatest width 3⅜ inches, thickness at hinge ¼ inch, at lip ⅛ inch; at proximal end of each piece of shell two holes drilled with old-time drill, showing crater effect; necklet cord (4) of three-ply braided human hair 2 feet 11½ inches long and averages 3/16 inch in thickness; pendants fastened to necklet cord by length of braid (5) ⅛ inch thick, which passes through holes and is knotted to necklet cord; pendants held apart by stretcher (6) of *ngangie* wood 6¾ inches long, ¾ inch wide, ¼ inch thick; ends of stretcher notched (7) and fastened to necklet cord by four transverse turns of fine two-ply twisted sinnet cord; turns finished off with circumferential turns between cord and stretcher. *c*, wooden comb (*yeia*) (Cl034) with two teeth (*matolua*) made of *ngangie* wood: 9⅝ inches long; handle (1) averages ½ inch thick; teeth 5⅛ inches long, ⅜ inch thick at 2, ¼ inch thick at 3. *d*, comb with three teeth (*matatolu*) (Cl035) made of *ngangie* wood; handle round and 1½ inches thick at 4; a pronounced shoulder (5) separates handle from short teeth (6) which are 2⅜ inches long and average ¼ inch thick. *e*, earring (*suhaeuvevenga*) of pearl, turtle, and coconut shell (Cl140): coconut-shell ring (1) ¾ inch in inner diameter and 1/16 inch thick, cut through obliquely at 2 so that ends can be opened and slipped through hole in ear lobe; thin plate of golden pearl shell (3), attached to ring, 7/16 inch high, less than 1/16 inch thick; attached to lower plate of pearl shell (5) by figure-of-eight connective of black turtle shell (4) which is 3/16 inch high, ¼ inch wide, and 1/32 inch thick; each half of connective slit (6) so that it may be slipped onto two plates of pearl shell; lower plate of pearl shell (5) 1 inch high and less than 1/16 inch thick.

301 Formerly when both sexes wore long hair, the hair was dressed with
302 wooden combs (fig.19,*c,d*). The two-pronged comb (*yeia mato lua*) was used to beat water from the hair after it had been washed; the three-pronged comb (*yeia mato tolu*) was used to arrange the hair and sweep it back before tying it together at the back of the head with a strip of pandanus. For ornamentation, the combs were often left in the hair. Though the wooden comb has gone out of use today, most women wear a trade comb as an everyday ornament.

STONEWORK

324 Because of the absence of basaltic stone, Pukapukan stonework is limited to the use of coral (*punga*), coral conglomerate (*kaupapa*), and coral pebbles (*hihihi*). Stone is used for paths, seats, walls, house foundations, well facings, fishweirs, graves, religious structures, and tools.

Paths

487 Paths and trails cut through the bush lead from the lagoon side to the outer beach side of the island. When they reach the outer beach, some paths are continued down to the sea and across sharp coral rubble by stepping stones of flat slabs of coral conglomerate placed over the rubble. They enable the fisherman or other visitor to the outer beach to walk to the sea without cutting his feet on the sharp stones.

921 Na Pongaponga-iyu-o-te-kiole, Nostrils-of-the-rat (visible binary, 4 ν Lyrae and 5 Lyrae). Some confusion over identification of the name. Likely that almost any visible binary may be correctly called by this name, in same way that Jupiter and Sirius may both be correctly called Tapao.

Te Tolunga-Mani, Three-Maui-Brothers (ζ, ε, and δ Orionis). Veti alone included Orion's sword as well as his belt in this constellation. Used as star course from Pukapuka to Olosenga and return.

Te Wao-a-Mani, Fishline-of-Maui (θ, η, ζ, ε, and δ Ophiuchi and α Serpentis). Most informants agreed on including these stars as the main ones in the Fishline, in reality a group of stars strung out north along the Milky Way from Scorpio. An unimportant constellation, figuring neither as star-course guide nor as fishing sign.

Taki-piki-tolu (group of stars in Piscis Australis). Veti and Pau maintain this identification, and refer Tolu alone to α, β, and γ Aquilae. Possibly this distinction is old.

Mataliki (Pleiades). Morning rising marks change of wind to southeast, heralds flying fish, reef fish, and bigger deep-sea fish (then full of roe) seasons. Hence the saying, "Tena te kau ika o Mataliki ka yau" (Here are all the fish of Mataliki coming). Formerly morning rising introduced the six-moon period of pleasuring. Mataliki directly overhead in the sky is a sign of turtles coming to lay eggs on the outer beaches.

Te Kau-o-Mani, Fishhook-of-Maui (cluster of 4th, 5th, and 6th magnitude stars in Sagittarius). Often confused with the tail of Scorpio, though it lies southeast from the southernmost stars in the tail.

Lua-tama-lelei, Two-beautiful-children or Lua-palotu-loloki, Two-beauties-close-together (λ and υ Scorpionis). Their modern name, Pipili-ma, is said to be Tahitian.

Taumakomako (γ, κ, and σ Scorpionis). Some informants do not recognize this constellation. Identification is doubtful, as it includes Antares, definitely named Melemele.

Te Ala-kavenga-o-te-ika, Star-sign-of-fish (Ursa Major). Descriptive name only because this constellation is known by all as sign for reef fish. Pau's identification given above.

Te Mumu-o-ngaua. Group of small stars known to some, could not be identified.

STAR COURSES

502 [487] The value of Pukapukan star courses from the viewpoint of modern navigation has been worked out by Robert Dean Frisbie, whose notes follow. The accuracy of the star courses to the west and from Samoa to Pukapuka is noteworthy. Informants knew of no star courses which would help a navigator sailing eastward from Pukapuka, an indication perhaps of the predominating contact of Pukapuka with western islands.

The course from Pukapuka to Niue was equal to the bearing of α and β Centauri (Na Mata-o-te-tokalua) when low in the sky to west of south. Informants emphasized that the stars must be low in the sky; evidently the old navigators were aware of the Centauri's rapid change of bearing when at a higher altitude (no such emphasis was laid on the Antares, or the σ Orionis, star course). Informants were not aware of the stars being in their lower transit when observed low in the sky; but a navigator sailing as far south as Niue, lat. 19° 10′ S., would undoubtedly observe this.

The true course from Pukapuka to Niue, calculated by Mercator sailing, is 204° 48′. The course that would be steered by a canoe headed toward α Centauri, at 5° altitude, would be equal to that star's bearing, which is, in the latitude of Pukapuka, 209° 10′. This is computed by the formula: $1/2\ Z = \sqrt{\text{con. } s, \cos.(s-p)}$, sec. L, sec. h. (In this $s = 1/2\ h+L+p$; Z is bearing; L, latitude; h, altitude; p, polar distance.)

1:Beaglehole and Beaglehole E-5 (1934-5) 1938 Pukapukans

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The course arrived at by the above altitude azimuth calculation is 4° 20′ to westward of the true course, and, if only one bearing was taken at the beginning of the course, it would take a canoe to a point approximately 30 miles to the westward of the south point on Niue. At this distance a native voyager would be aware of the proximity of land as well as its direction. He would, however, arrive at a point somewhat closer to the land, for as the canoe sailed south, α Centauri's bearing when low in the sky would shift to the south, due to the star's being in its lower transit. Thus the navigator, by degrees imperceptible to himself, would shift his course more and more to the south, as follows:

At Pukapuka the true course would be roughly 205° while the bearing of α Centauri is 209°.

After sailing 200 miles the true course would be 203.5° while the bearing of α Centauri would give a course of 208.5°.

After sailing another 200 miles the true course would be 198° while the bearing of α Centauri would give a course of 207.5°.

Another 100 miles and the true course would be 178° while by steering by α Centauri the navigator would be making a course 207°.

Finally, after following the last course for 65 miles, the navigator would fetch up at a point 31 miles to the west of Niue.

Steering by a course equal to α Centauri's bearing when lower in the sky would bring the navigator closer to Niue; while if the bearing of α Centauri was taken when it was high in the sky there would be little appreciable difference until the star was above 15°, when it would go into its upper transit. This rule, however, would not hold true when the canoe had made considerable southing, but the variation in the course made good would be slight.

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If, as some of the Pukapukans claim, Nassau was used by the old navigators as a point of departure, then a canoe headed for Niue would fetch up within 12 miles of the land. It is perhaps within reason that a navigator would stop at an uninhabited island, such as Nassau, where an abundance of food could be gathered for the voyage.

An interesting detail in relation to the α Centauri course lies in the fact that during July, August, and September, when the star sets during the early part of the night and thus is in a position to be used as a bearing, the normal winds in this part of the Pacific are favorable for the voyage to Niue, blowing steadily from the east to northeast.

Informants state that the old navigators steered a course to Upolu which was equal to the bearing of Antares (Melemele) when low in the sky to westward. As it is improbable that this star would be visible, over a period of nights, when below 15° altitude, that altitude has been used in calculating the true course that such a bearing would give. The results follow:

True course to Apia by Traverse Tables	243°
Course by Antares at 15° altitude	245°
Course by Antares (at setting. Asup. tab.)	243°

Antares is last seen to westward during the latter part of October, and thus it is in the western sky during the trade-wind months when the weather is favorable for the above voyage. Also, being a conspicuous red star, in a line with and between γ and σ Scorpionis, it is easy to pick out on a cloudy night.

Informants gave Orion's Belt (Te Tolenga-Mauí) as the star course for the voyage from Pukapuka to Olosenga. Taking it at 15° altitude, the course equal to its bearing is 271.5°. As the true course is 264.5°, the star course is in error 7°, and this error would fetch the canoe to a point 31.5 miles to the north of Olosenga. Due to many kinds of sea birds nesting on Olosenga and flying far to sea to feed, the native voyager would be aware of the proximity of land as well as its direction well beyond a 31.5 mile radius. Also, it is probable that after the first few voyages, navigators learned to sail a little to the left of Orion's Belt. Orion sets to westward during the early part of the trade-wind season, when the weather is favorable for the voyage. If, as one suggests,

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the voyagers made their departure from Manuae Island, they would fetch up within sight of Olosenga.

In sailing to the Gilbert-Ellice Islands, informants state that the navigators used Altair (Tolu). Sailing from Pukapuka, almost any course between 277° and 300° would take a canoe to a point close to one of the islands in the Ellice or the Gilbert groups. A course by Altair at setting is equal to 279°. As it rises higher in the sky its bearing swings to the north. It is visible at setting during the latter half of the trade-wind season when the weather is favorable for the voyage.

In voyaging from Samoa to Pukapuka, the Pukapukan navigators sailed from Upolu to Olosenga; then sailed on to Pukapuka using *l*, *s*, and *t* Orionis (Te Tolunga-Maui) as their star course. These stars would give a course of 88°, while the true course is 84°, and by taking from Traverse Tables under 4° (the difference between the true and the star course), and with the distance at 259 miles, one finds that the star course would put a canoe 18 miles to the south of Pukapuka. This is approximately at Tima Reef, which place would give a new point of departure for the canoe for the rest of the voyage. In case the canoe missed Tima Reef, due to bad steering or cloudy weather, it would still be likely to come within sight of Nassau or Pukapuka; and even if it missed all three landfalls, it could scarcely fail to come within a point 30 miles to the north or south of one of the islands, which point would be within sea-flight of the white terns—the sign of land. Hence, in sailing from Olosenga to Pukapuka, a distance of 259 miles, the navigator has a cross section of ocean, lying at 45° angle to his course, 110 miles long, in which to make his landfall.

Stress is laid on this point, for, to a casual observer, it seems little short of miraculous for a canoe to pick up a tiny atoll in mid-ocean. As a matter of fact, in the above case, it would be remarkable if the voyagers missed one of the two islands or Tima Reef.

Finally, the Orion's Belt course from Olosenga to Pukapuka is peculiarly advantageous as these stars are visible to eastward during the early part of the hurricane season when the winds are favorable for the return voyage. Later in the hurricane season—February and March—the winds are also westerly, but it is doubtful if a canoe would attempt the return voyage during these stormy months and, moreover, Orion's Belt would be too high in the sky to be used as a bearing. It is most likely that the return voyage would be made in December, when the winds are light from the west and Orion's Belt is low in the sky to eastward at sunset.

COUNTS AND MEASURES

The Pukapukan system of counting follows the general Polynesian system. It shows a high development of number prefixes used when counting different classes of objects. The list of numerals is:

1. Tayi	90. Lau lua
2. Lua	91. Lau tolu
3. Tolu	100. Lau
4. Wa	101. Lau ma tayi
5. Lima	111. Lau ma laungaulu ma tayi
6. Ono	200. Lau lua
7. Wiku	300. Tolunga lau
8. Valu	400. Wanga lau
9. Iva	1000. Mano
10. Katoa or laungaulu	2000. Lau mano
11. Laungaulu ma tayi	10,000(?). Tini
12. Laungaulu ma lua	100,000(?). Ngauku tini

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This disastrous voyage to Samoa is probably the last of the deep-sea voyages of the Pukapukans to foreign lands. Occasional fishing trips are still made to Tima reef, but there is no record in recent years of any deep-sea voyage with native canoes.

Summary

A survey of the voyages recorded in the previous pages indicates that the majority were made to lands to the west of Pukapuka. The Tokelau Islands, Tonga, Niue, and Samoa were frequently visited. It is perhaps reasonable to assume that some of the other names mentioned refer to islands to the north of Pukapuka, the Equatorial Islands. The land of Yayake still remains a puzzle, not rendered more easily solvable by the reference to Rarotonga. As this land is identified by some as Tahiti, it may be instructive to discuss the possibility of canoe voyages between Pukapuka and Tahiti. I am indebted to Robert Dean Frisbie for the material on navigation in the following paragraphs:

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The island of Raiatea may be used as a destination rather than Tahiti because it is closer to Pukapuka (940 miles) than is Tahiti (1080 miles), and it would be sighted by a canoe sailing direct from Pukapuka to Tahiti. The navigator's course to Raiatea from Pukapuka is 115° east southeast.

A canoe sailing from Pukapuka to Raiatea would require a light wind from northeast by north or farther north. No wind to the east of 32° would be serviceable because a native canoe at sea can not make good more than one point into the wind and if the wind blows at more than force 3 (Beaufort scale), the canoe can not make good a course closer than 90° to the wind. Winds from north of northeast blow in this part of the Pacific only during the hurricane season from November to March. At Pukapuka northerly winds are fairly steady and moderate, but to the eastward, these northerly winds give way to easterly winds. A wind shift to the north is generally followed by a gale from the northwest which a Polynesian canoe could not weather.

It would be practically impossible for a Pukapukan canoe to beat to Tahiti against a head wind. To do this, it could scarcely make more than 20 miles a day on a true course, and for this it would have to sail a little over 100 miles each day. A canoe beating towards Tahiti would be at sea for at least 47 days, changing the course continually as the wind shifted. If, at the end of this time, any island of the Society group was sighted, it would be due to singular luck and not design. No star course would be of value, for the canoe would be changing course continually. Even if a navigator knew by experience that a certain star at rising lies towards Tahiti, it would be impossible for him to shift his courses so that they would average one equal to the true star course.

All this does not discredit the fact that the early Pukapukan navigators could and did make long sea voyages with a fair or even a beam wind, short voyages also with a head wind if the wind was mild and the navigator was clever enough to keep track of his position. That the Pukapukans were well aware of the impossibility of long voyages against a head wind in the hurricane season is shown by the fact that when they sailed to Upolu from Pukapuka they had a fair wind; coming back to Pukapuka, they did not attempt to sail direct (against the wind), but sailed first to the Tokelau Islands.

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502 487 waited there for the hurricane season, and, as is demonstrated by their star course, then sailed back to Pukapuka with a beam wind.

The only possible way for a Pukapukan navigator to reach Tahiti from Pukapuka would be to make easting in short journeys from island to island, in high equatorial latitudes, during November or December, wait, say, at Tongareva, for a mild northerly wind, and then make more easting before the wind shifted back to west so that he was in a position to sail the rest of the way to Tahiti with a beam wind. Mr. Frisbie regards this as possible on paper but difficult in actual fact. A return voyage from Tahiti to Pukapuka would not be so difficult. It might take about 10 days or more under favorable conditions, though it might be relatively hard to make a landfall at Pukapuka.

Pukapukan traditions speak of several voyages to and from Yayake. In the light of the above-mentioned navigational difficulties and the fact that the Yayake people in their immigration to Pukapuka landed and settled on the southern side of Motu Ko, it is perhaps justifiable to assume that Yayake was not to the east of Pukapuka, but somewhere to the south or west. This would lead to the suggestion that Yayake lay in the direction of Tonga, and it is quite within the realm of possibility that this is the old Pukapukan name for an island there or for one of the Fijian islands.

MASTER IDEAS OF PUKAPUKAN CULTURE

181 The key to the patterns of social organization is to be found in a brief analysis of the master ideas or controlling motifs of Pukapukan culture. These are both extraverted and realistic. The realistic construct of the culture is evident in social patterns, in myth, story, chant, and in everyday life. Thus, when the Pukapukan has occasion to greet an old, sick woman, hobbling along the village road, he remarks: "Where are you going, lady, you with your sickly and crippled walk?" There is no felt need to gloss 181 over the situation and insinuate, as with us, that all is for the best and that 761 even a semi-invalid is walking better each day. Again, when one asks an old man, obviously soon about to die, to name his descent lineage, more often than not the question one puts is: "Where are they going to bury you, old man, when you die in a day or so?" No offence is ever taken at the apparent crudity of such questioning; the old man is fully cognizant of the fact of death and is able realistically to face it and joke about it. This is in line 181 with the general Pukapukan attitude toward death; it is one of extreme 522 realism, not at all one of fear, though fear may come later when it is suspected that spirits of the dead are malicious trouble makers. Again, Pukapukan humor concerns itself almost exclusively with either the functioning of physiological processes in other than the appropriate social situation,